
The EPA team and Partner Agencies conducted a review of the Newark Bay Study Area (NBSA) Data Gaps Report (Tierra, March 2013).

In general, the EPA disagrees that the data presentations and evaluations in the Phase I and Phase II Data Evaluation and Analysis Report (DEAR; Tierra, March 2013) and Data Gaps Report are an adequate basis to conclude at this time that no further sampling is required to characterize the nature and extent of sediment contamination in Newark Bay. Additional review of Tierra's statistical analyses performed by Kern Statistical Services were submitted to Tierra (please refer to email and comments sent to Tierra 12/18/2013).

1. Section 3.3, pages 7-8. The Data Gaps Report provides the following observations regarding broad patterns of sediment contamination in Newark Bay:
 - a. Locations of statistically higher chemical concentrations (as compared to the overall mean for Newark Bay) were found in Newark Bay South, to the west of the navigation channel and in historical net depositional areas.
 - b. Geomorphic areas with statistically higher contaminant concentrations consisted of the Industrial Waterfront and the Historically Disturbed Subtidal Flats. The remainder of the Subtidal Flats contained statistically lower chemical concentrations (compared to the overall Newark Bay mean).

Based on these observations, the Data Gaps report concludes that "surface and subsurface sediments have been...characterized sufficiently to support...an understanding of broad spatial COPC patterns in the NBSA."

These observations do not fully capture gradients /spatial trends observed horizontally across Newark Bay. For example, our review of Figure H-1A [refer to Appendix H, Phase I and Phase II Data Evaluation and Analysis Report (DEAR)] suggests that from a qualitative perspective, there is a spatial gradient in 2,3,7,8-TCDD concentrations along the bay (higher in Newark Bay North). Review of the box and whisker plot of these data (Figure G-37) also indicates the presence of a longitudinal gradient within the NBSA. That is, there is a general trend from left to right of decreasing concentration of 2,3,7,8-TCDD, from Newark Bay North to Newark Bay Central to Newark Bay South. This pattern of monotonically decreasing concentrations would be augmented if data from the Lower Passaic River had been located in order spatially, to the left of this sequence, on Figure G-37.

The statistical tests employed in the DEAR and Data Gaps Report may not have been optimal for purposes of detecting differences in regional means. While regional means may not have appeared significantly different when comparisons were made with respect to a categorical variable (*e.g.*, overall Newark Bay mean concentrations), it is unclear if this would be the result if an alternative statistical test had been used to detect spatial trends or gradients. Specifically, testing the data with respect to a continuous variable (*e.g.*, river mile), rather than a categorical variable, must improve statistical power and the ability to detect spatial trends.

In addition, Tierra cannot rely on qualitative assessments that a certain number of cores are adequate to characterize a geomorphic unit (*e.g.*, "...each geomorphic unit had at least three cores that captured the depth of the 1940 horizon."; see top of page 7 of Data Gaps Report). EPA has concluded that further sediment sampling is required to characterize spatial patterns of

contamination in NBSA for the Remedial Investigation (RI) report. The evaluation and planning of additional sampling must be conducted during development of the Phase III Work Plan. The statistical evaluations presented in the Data Gaps Report are not adequate to confirm that the associated data quality objectives (DQOs) have been met, and that conclusion must be removed from Section 3.3.

2. Section 4, first bullet on page 11 and last paragraph on page 11. The EPA disagrees that no further data are needed to satisfy the intent of RI Goal 1 and that surface and subsurface sediments have been adequately characterized with regard to contaminant nature and extent. The Data Gaps Report makes the statement that RI Goal 1 has been met without the benefit of having an *a priori* set of criteria, established in coordination with EPA, to assess what it means to “adequately characterize” the nature and extent of sediment contamination. During negotiations with EPA for the Phase I and Phase II Remedial Investigation Work Plan (RIWP) sediment sampling scopes, Tierra consistently indicated that additional components of a sediment nature and extent sampling program requested by the Agency would be addressed in Phase III, as summarized below.
 - a. Response to EPA Comment No. 127, Tierra Responses to USEPA’s Compiled Comments dated March 4, 2008 (page 9): “Tierra...notes the stated purposes of Phase I/II – collection of preliminary data for the purposes of scoping the major RI field effort.”
 - b. The following comment responses were taken from the Tierra Responses to USEPA’s Compiled Comments dated April 27, 2007.
 - i. P. 18, Response to Comment No. 5. “Tierra intends to utilize the information collected in Phase II to complete the DQOs/PQOs established for Phase I. This will allow for a more effective assessment of the Bay, and for the development of a more refined nature/extent data collection effort to be conducted in Phase III.”
 - ii. P. 25, Response to Comment No. 38 (Future sampling may need to include finer segmentation for dated sediment cores...). “Considering the PQOs identified in the draft Phase II RIWP (October 2006), Tierra does not agree that a finer segmentation scheme is appropriate or consistent with the current objective and scope. However, this concept will be re-visited once a more in-depth analysis of the Phase I and Phase II data has been conducted.”
 - iii. P. 35-36, Response to Comment No. 90. “For the purposes of the revised Phase II RIWP, Tierra will acknowledge that additional work related to both nature/extent and source identification sample collection will be needed in the future.”
 - iv. P. 36, Response to Comment No. 92. “Tierra agrees that both the Peripheral Ditch and Pierson’s Creek require further investigation...Tierra will submit to USEPA for approval, a Work Plan for sediment sampling in these areas.”
 - v. P. 38, Response to Comment No. 94. “...Tierra proposes to defer any potential source-related sampling in the Hackensack River until such time that all of these data can be properly evaluated and assessed.”

- vi. P. 39, Response to Comment No. 100 (need for better characterization of the variability within each geomorphic area). "...the Phase I and Phase II collection efforts will serve to inform later sampling design efforts...Tierra will be assessing this as part of the separate data assessment process."
- vii. Tierra deferred the response to Comment No. 6 (future work must include a sampling plan to analyze suspended solids entering Newark Bay via the Kill van Kull; RI Goal 3) to a future investigation, since this was "thought to be associated with the risk assessment and/or source identification/modeling processes."
- c. Teleconference notes from a Phase II RIWP comment call held on March 21, 2007 record the following statements from Tierra and their consultants:
 - i. "Hopefully, the Phase II RIWP doesn't suggest that (Tierra) is shutting the door on source identification or nature and extent of contamination."
 - ii. "(Tierra) is considering additional samples in the Kill van Kull."
 - iii. Tierra referred to "Phase III nature and extent investigations."
- d. In the Tierra document titled Responses to Big Picture Comments on the Phase I RIWP as Received on March 30, 2005, dated May 2005 and revised September 2005, the response to Comment No. 4, Bullet 7 (page 11 of 20 of August 30, 2005 document) states that "No statistical basis was used to select the number of sample locations. Judgmental decisions...were used to select the number of sample locations within each geomorphic strata (*sic*)..." Many of the Phase II coring locations were only co-located with Phase I locations to obtain deeper sediment where Phase I cores failed to penetrate to the 1940-era layer, and while Phase II cores were also added to investigate the historical depositional locations, it was remarked during RIWP review discussions by EPA that Phase II was in effect a sort of 'Phase IA.'

The EPA expects Tierra to prepare and develop appropriate Phase III sediment nature and extent sampling goals, which should include for example, additional characterization within the subtidal flats and tributaries/tidal straits , in coordination with EPA, to complete the dataset that will be needed for the future RI report.